

Analysis of GMI Combo Simulations

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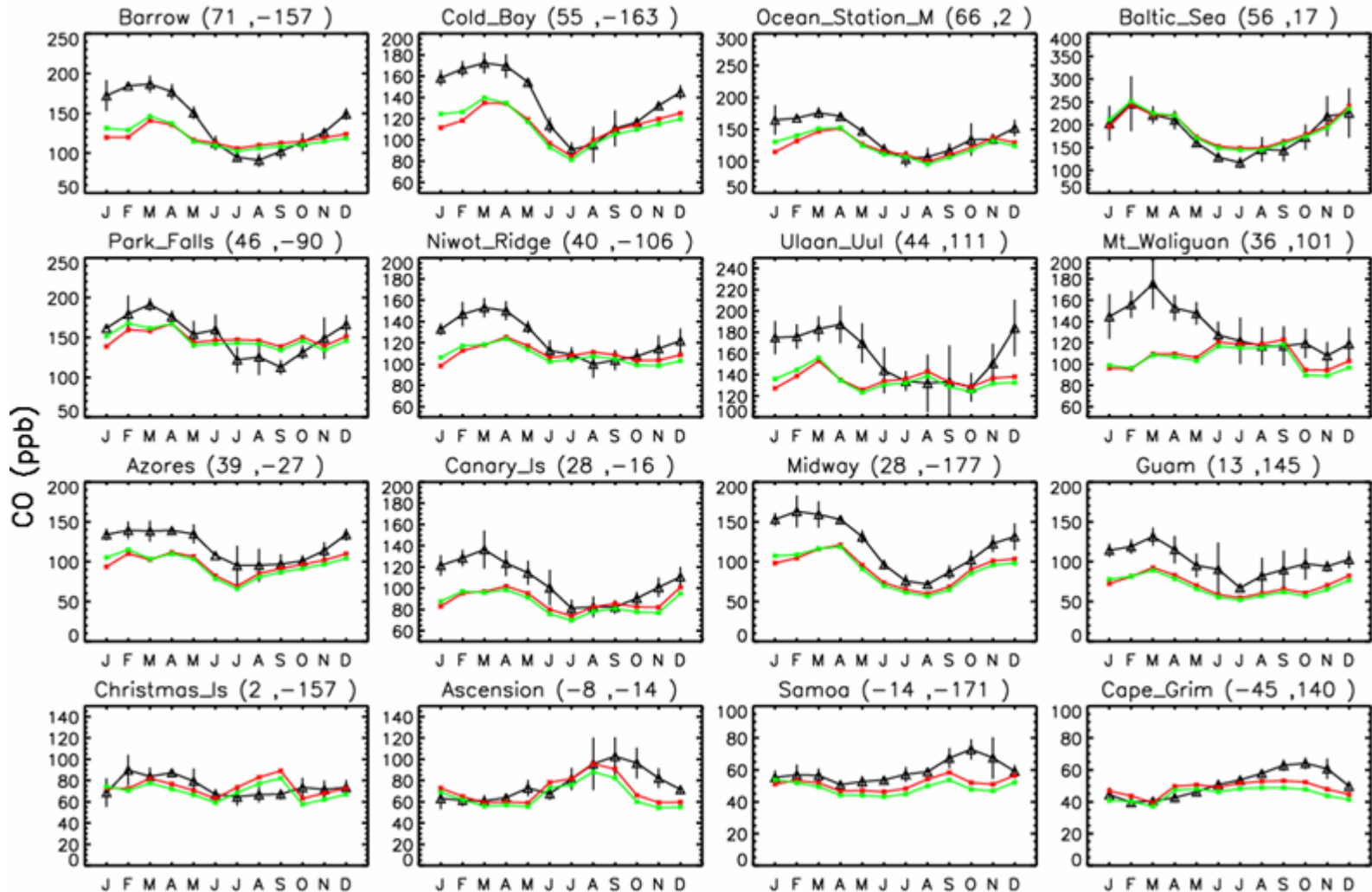
Topics

- **Comparison of the 4x5 Combo and Trop. runs using the same year of FVGCM winds**
- **Evaluation of the 2x2.5 Combo GCM and DAS runs in the troposphere**
- **Comparison of the 2x2.5 Combo DAS run to TES data**

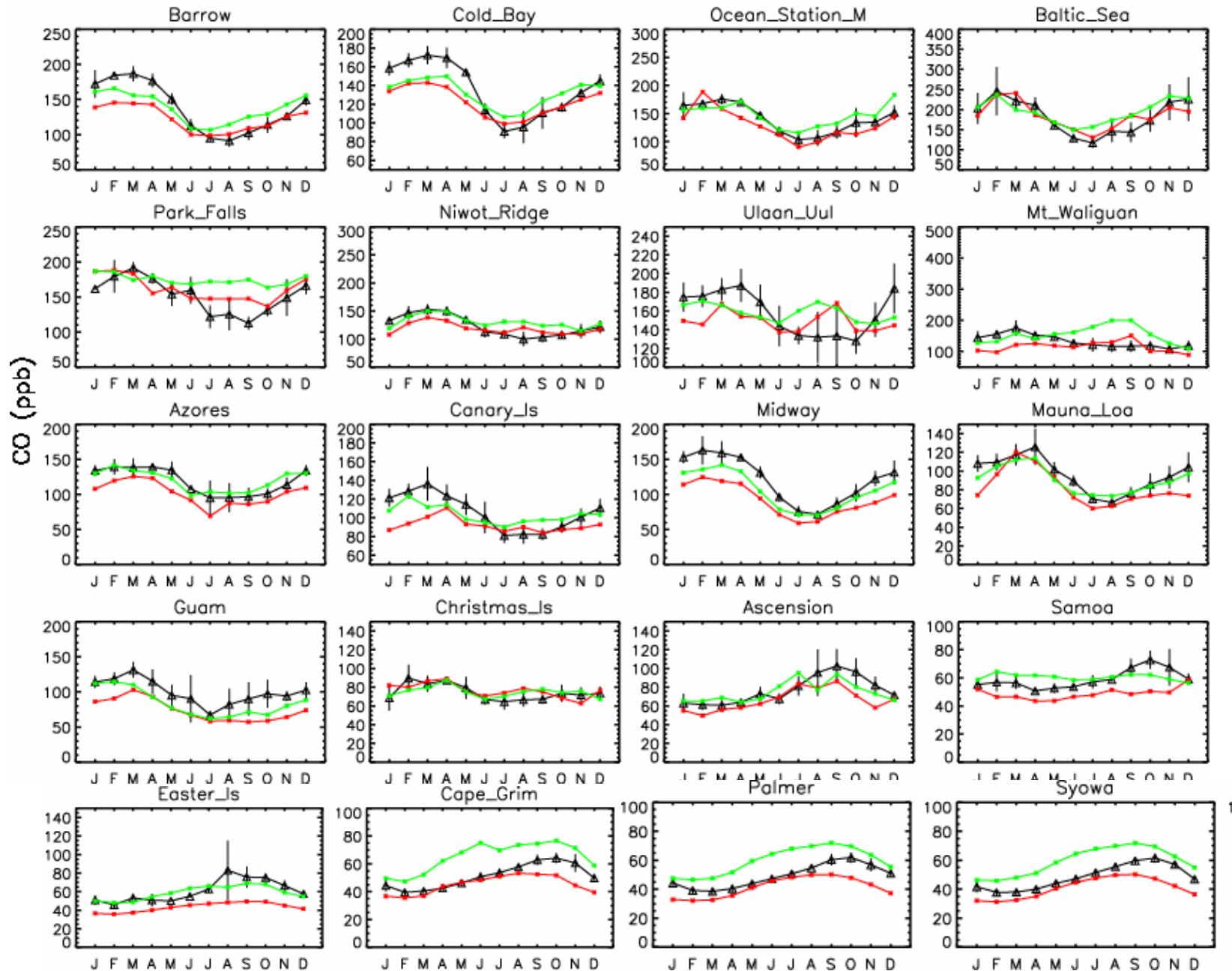
Surface CO: 4x5 FVGCM COMBO and TROP runs

VERY SIMILAR to each other, as they should be.

FVGCM winds. Combo – red, Trop – green.



Surface CO, 2x2.5 COMBO, **GCM** and **DAS**

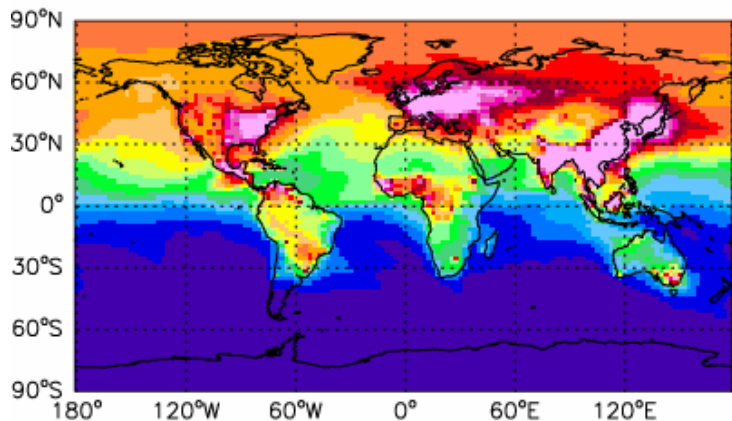


CO, April, at the surface

CO (ppb), surface, April

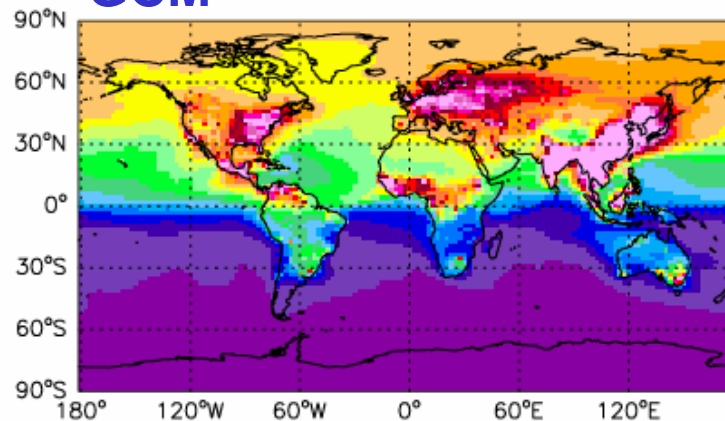
DAS

DAS



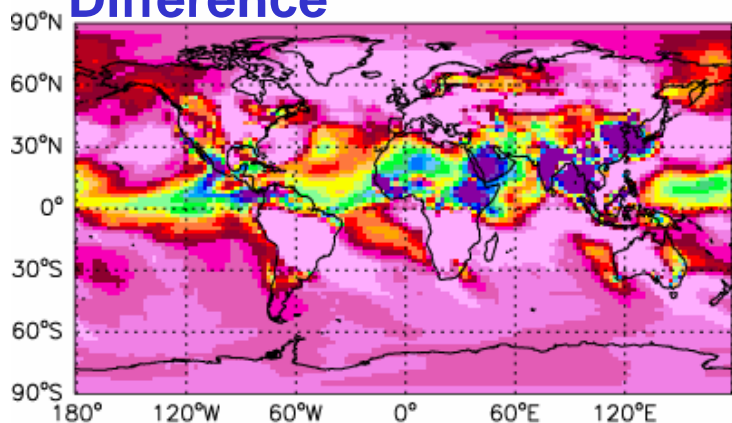
GCM

FVGCM



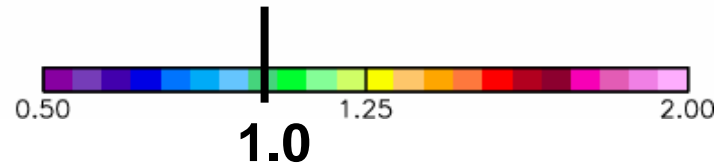
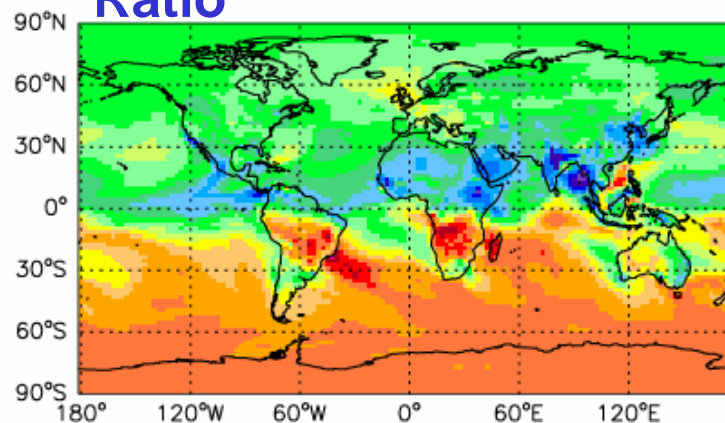
Difference

DAS-FVGCM



Ratio

DAS/FVGCM



CO simulations.

2x2.5 runs:

- DAS is consistently higher than the GCM run
- Are these runs self-consistent?

4x5 runs:

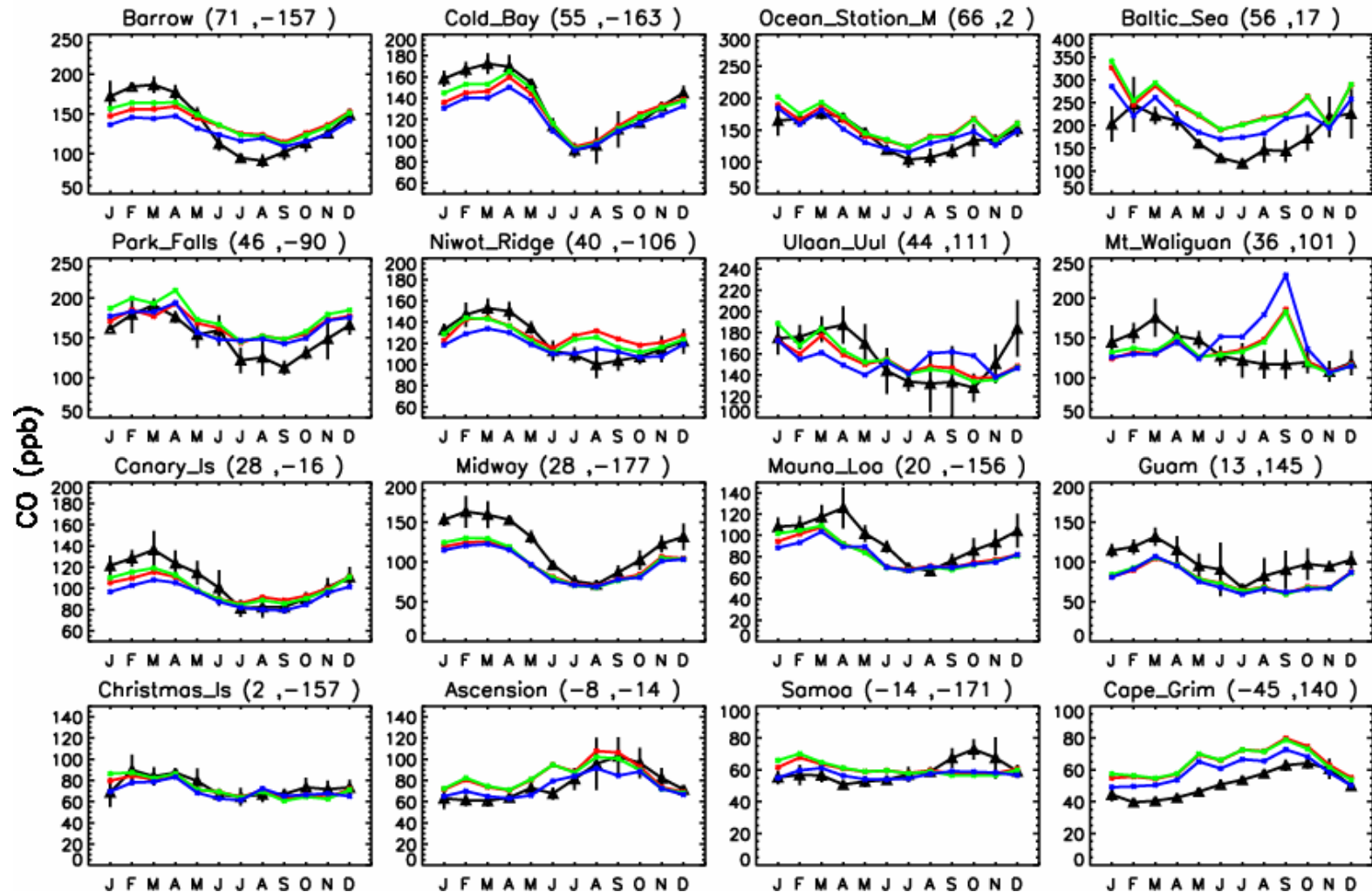
- Combo and TROP similar to each other

Why is CO lower in the 4x5 GCM combo than in the 2x2.5 GCM combo?

Are these runs self-consistent?

Surface CO, GEOS-Chem, GEOS-4, GEOS-3: Note change in CO from GEOS-3 to -4 (OH, clouds).

Red: v5-07-08 (2001); Green: v7-02-03.geos3 (2001); Blue: v7-02-03.geos4 (2001)

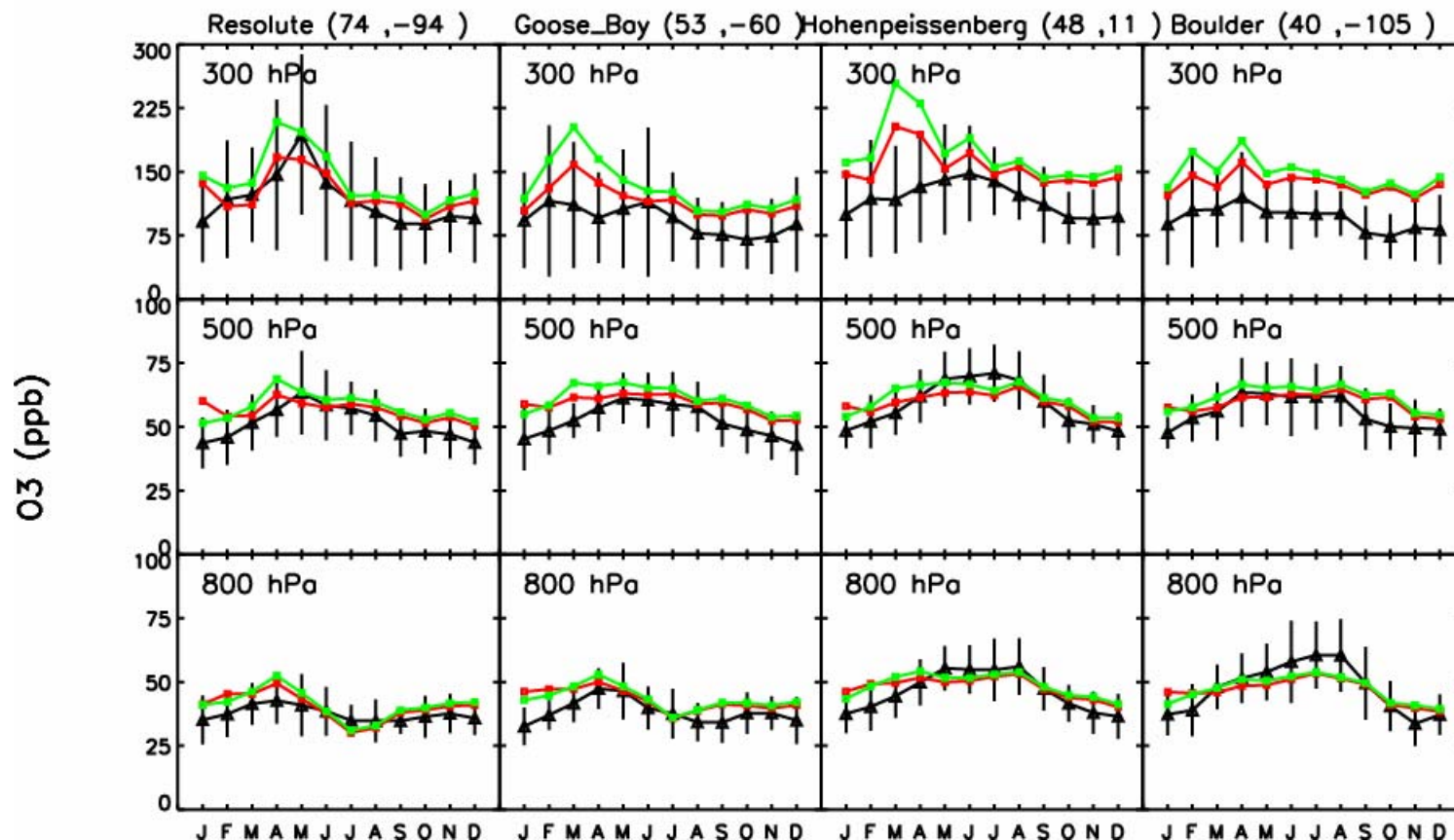


OZONE in 4x5 COMBO, TROP.

- **TROP FVGCM run uses SYNOZ**
- **Old runs from 2005 available with zero SYNOZ, used to isolate stratospheric ozone tracer**

COMBO
TROP

Ozone at N. extratropics, COMBO vs. TROP



COMBO is lower in upper troposphere, extra-tropics, results very similar everywhere else.

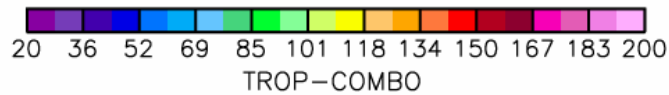
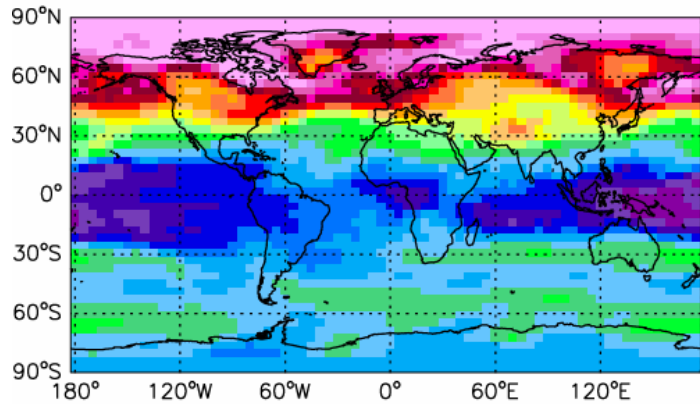
Ozone at 300 mbar, April.

Combo lower in the extratropics only

O₃ (ppb), 300 mbar, April

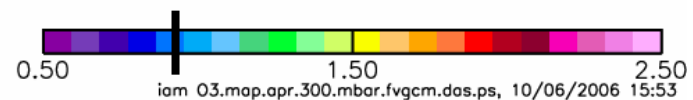
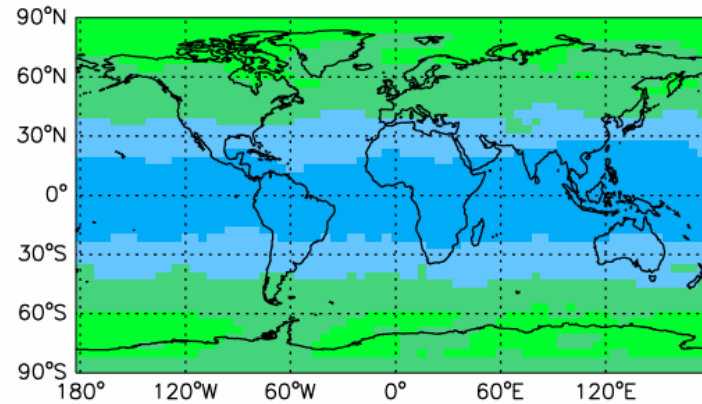
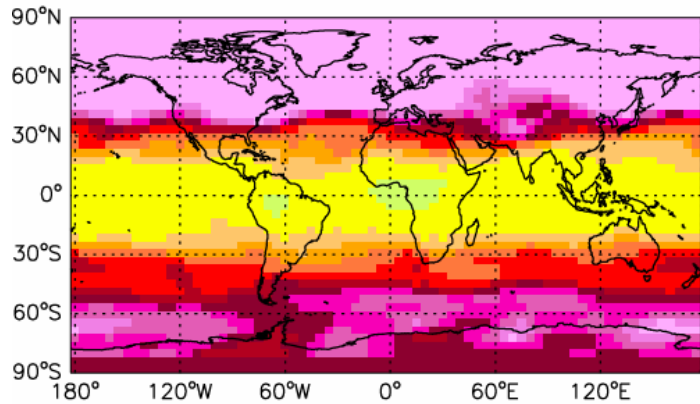
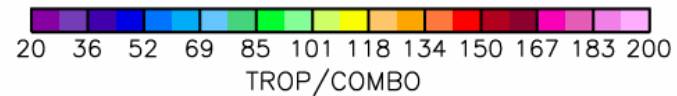
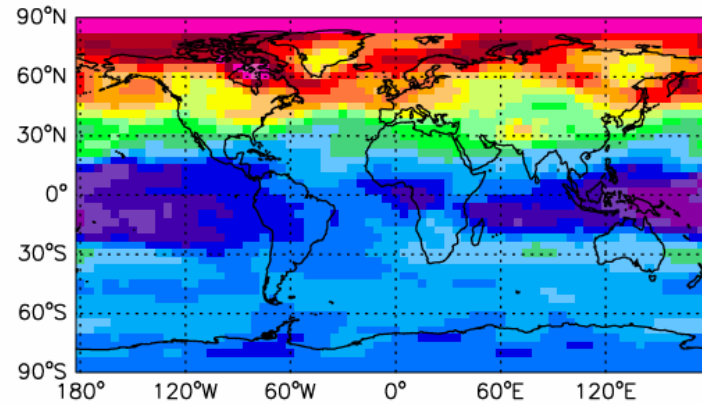
TROP

TROP



COMBO

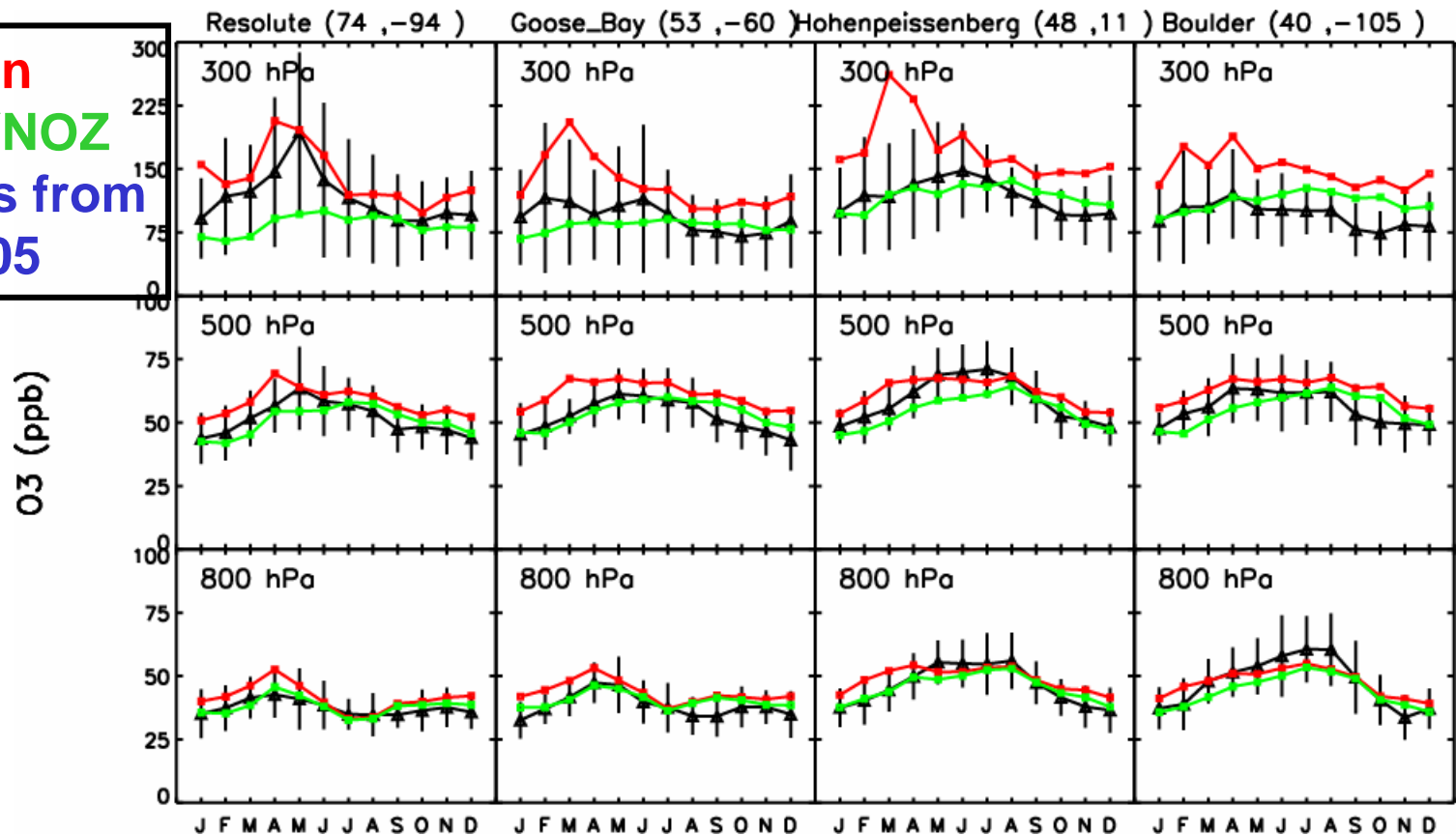
COMBO



Effect of the stratospheric source on trop. ozone in FVGCM

- The Trop. run with a SYNOZ flux of zero shows the effect of the stratospheric source on tropospheric ozone
- Since the Combo and Trop runs are very similar, this should separate the strat. and trop. sources of ozone for the Combo also

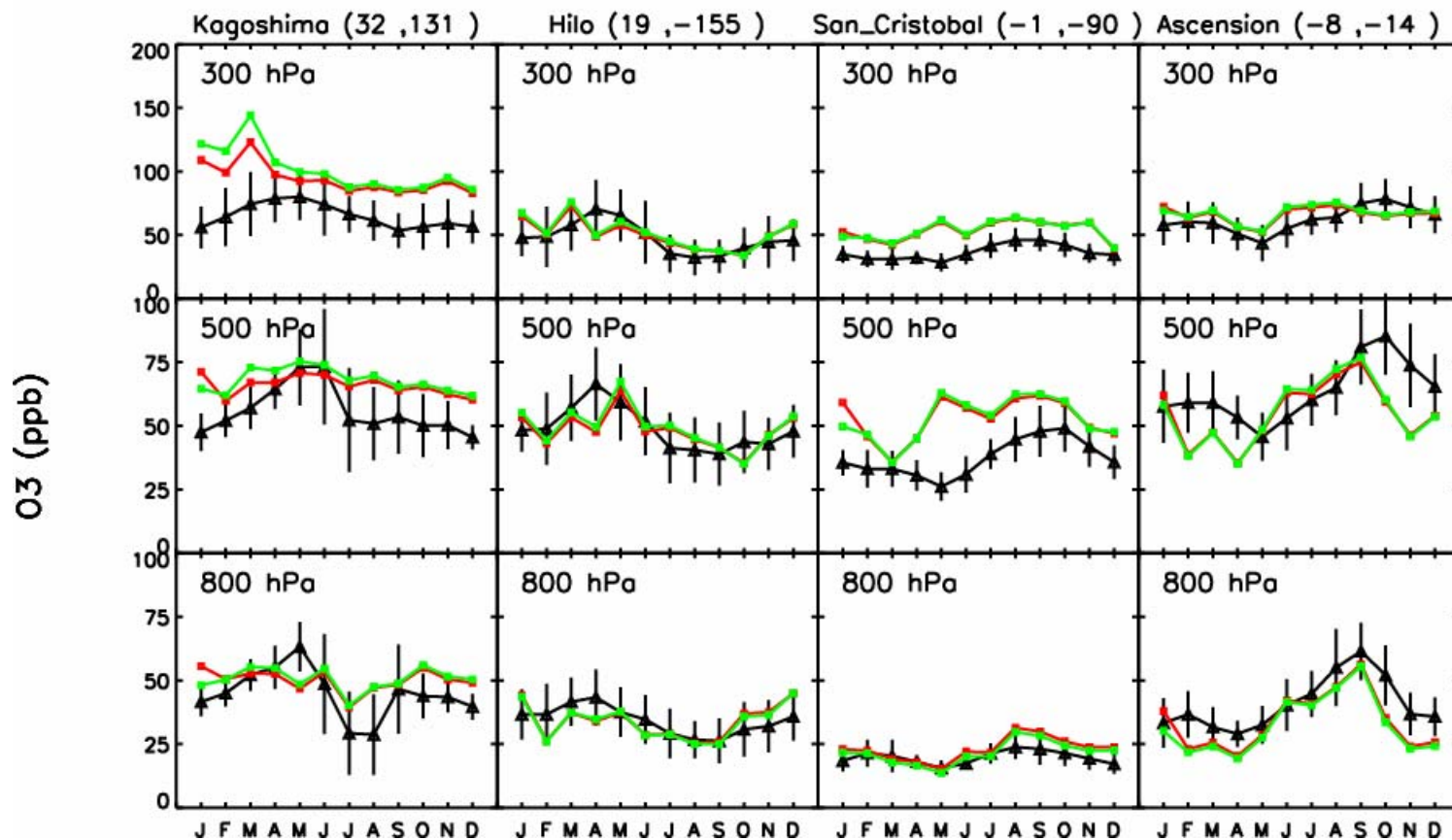
Trop. run
Zero SYNOZ
Old runs from
Late 2005



COMBO
TROP

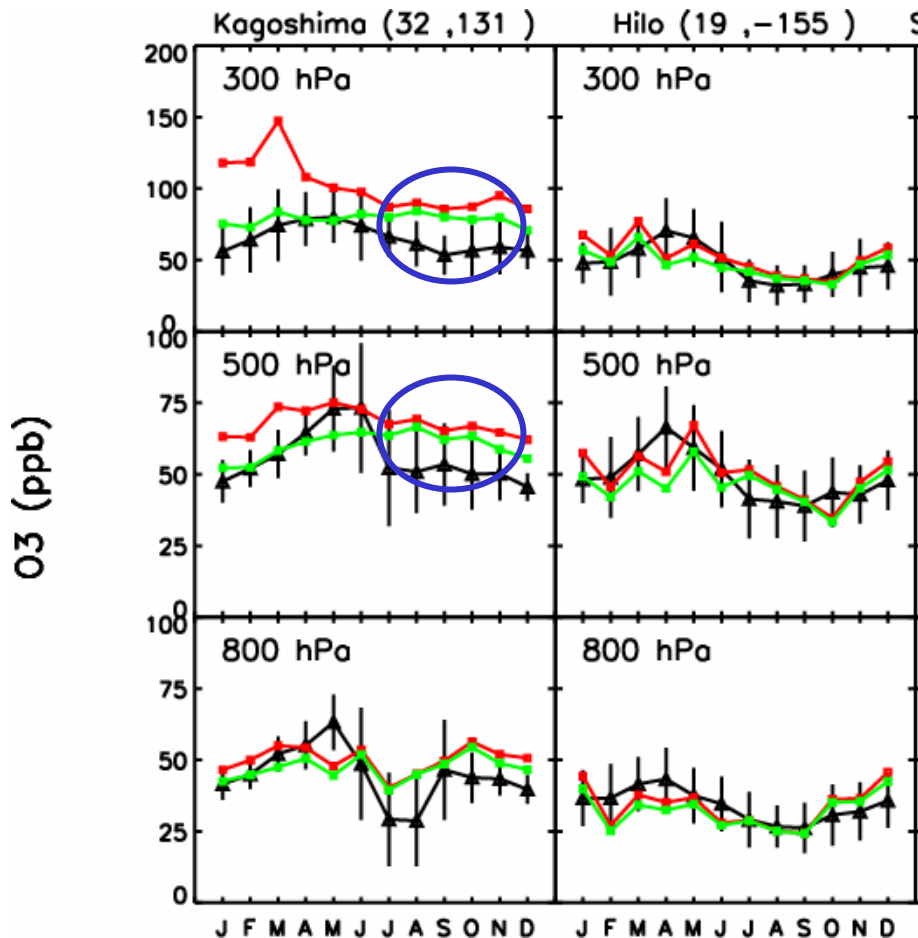
Ozone, sub-tropics to tropics

Note that Hilo looks good, San Cristobal looks bad.



FVGCM - Japan

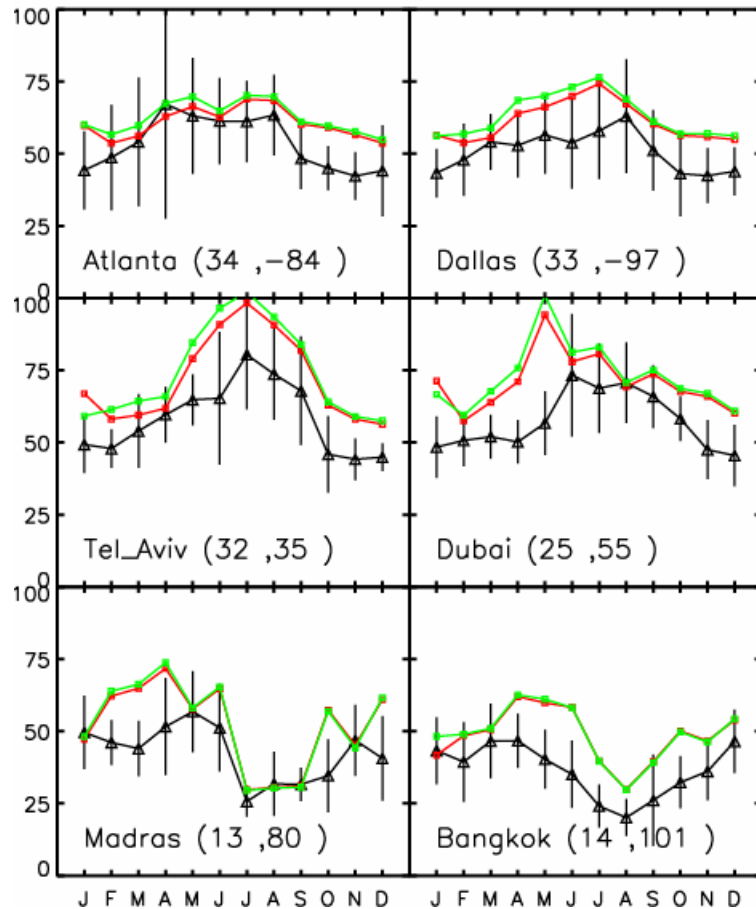
Trop. run
Zero SYNOZ



- Overestimate in S. Japan is a problem with the tropospheric simulation in fall
- The overestimate at 300 and 500 hPa at Tatenos (36°N) and Sapporo (43°N) in Jan.-Mar. may be caused by too large a strat. source

Southern US, Middle East, and S. Asia, 500 mbar

500 mbar. FVGCM winds. Combo – red, Trop – green.



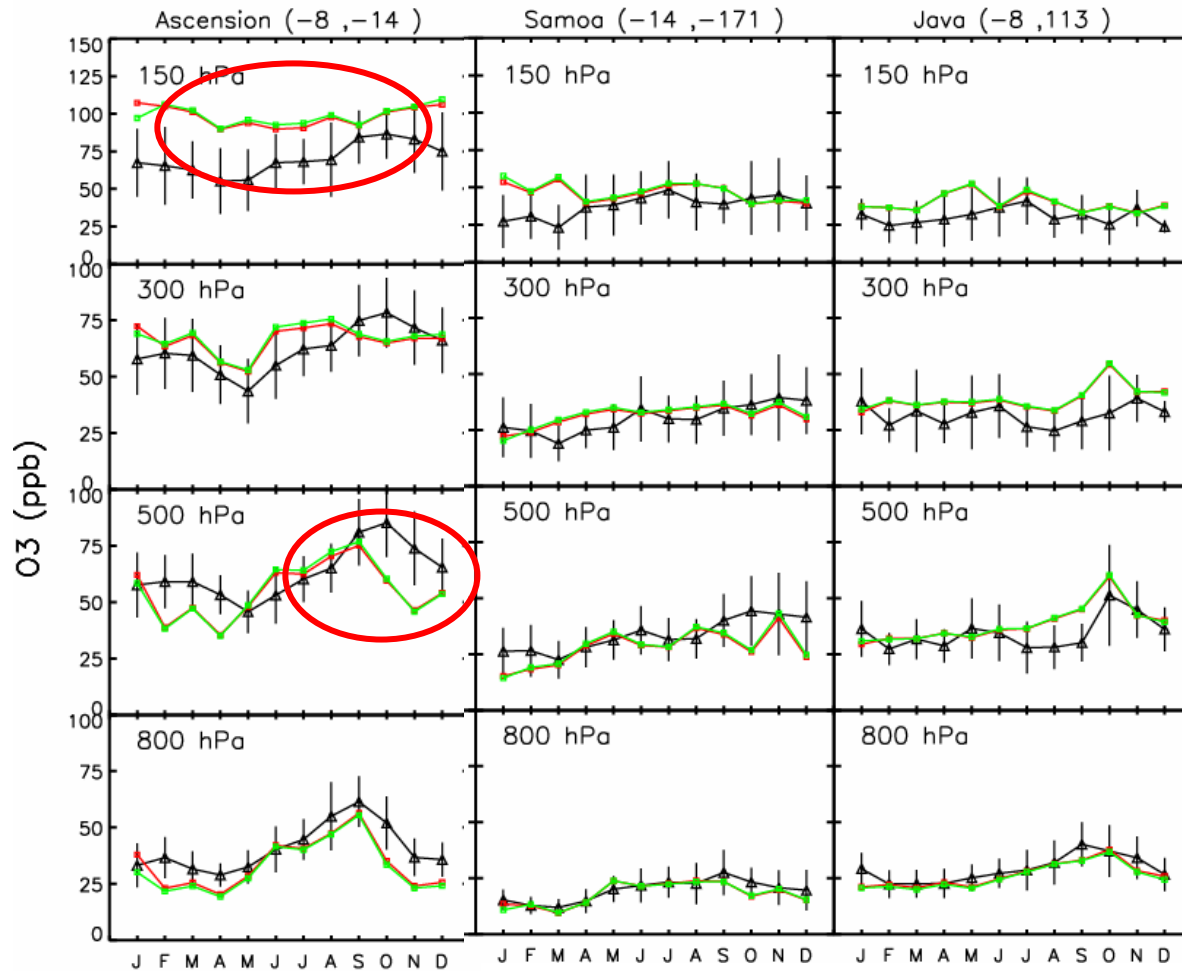
Too high in summer over Dallas, less so over Atlanta

Too high for Middle East summer maximum.

Too high in winter-spring.

Ozone – tropics

– red, Trop – green.



Largest discrepancy in tropical Atlantic UT, and in Eastern Pacific.

Other tropical stations Look good.

Ascension

Samoa

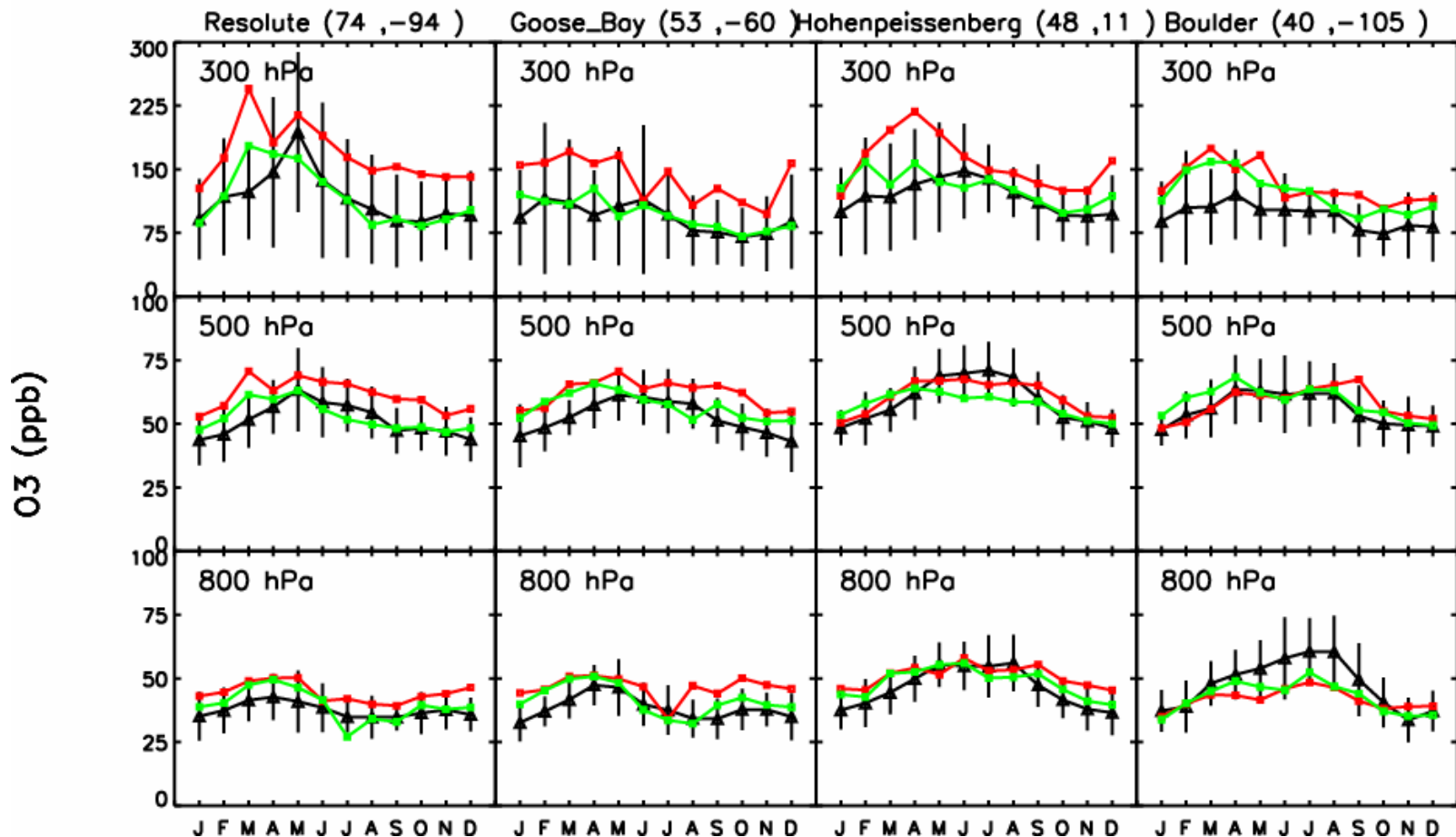
Java

OZONE in 2x2.5 COMBO, FVGCM and DAS

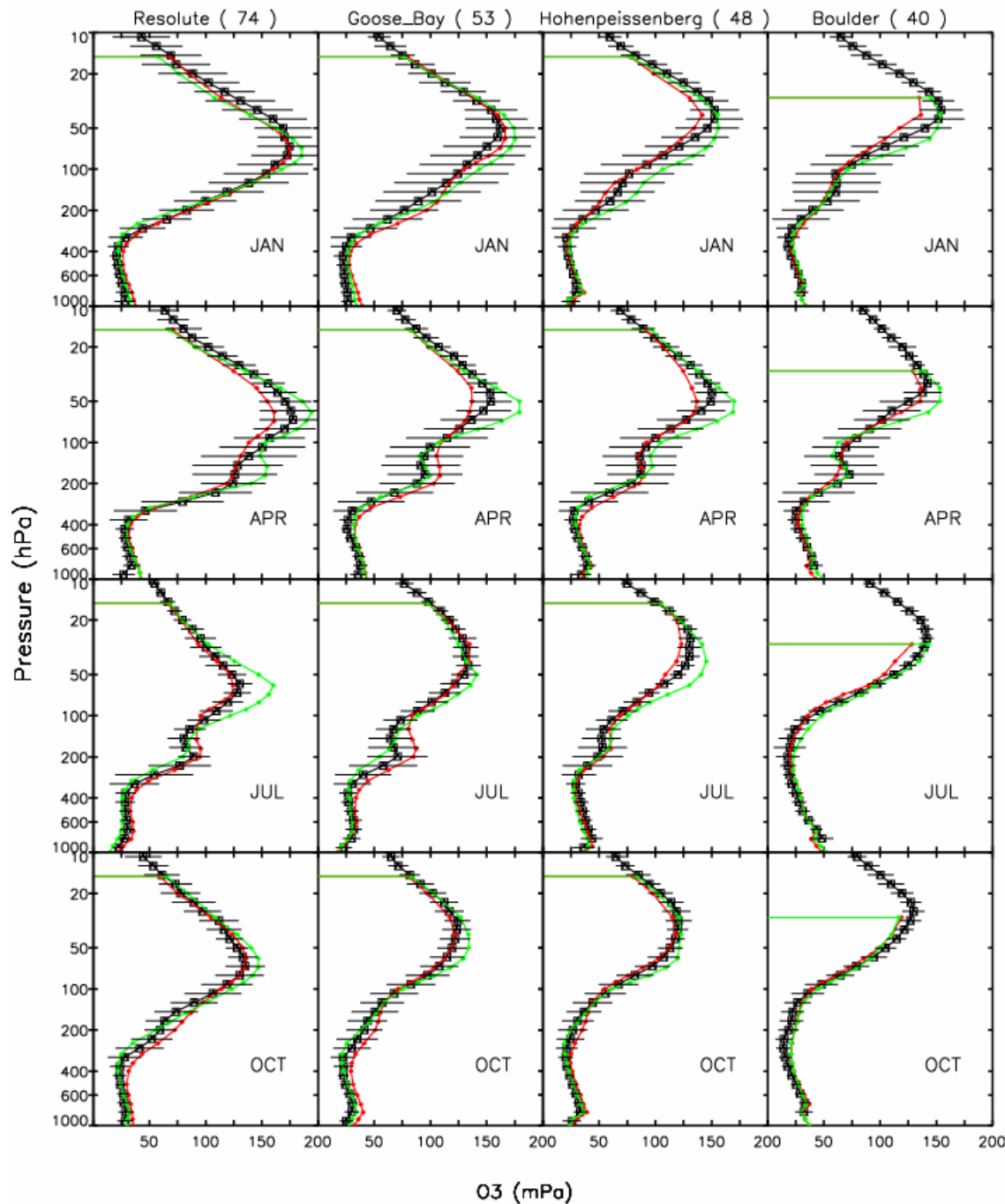
Ozone at N. extratropics, FVGCM vs. DAS

FVGCM is higher in UT (latitudes > 45)

The DAS run looks great! The best yet.



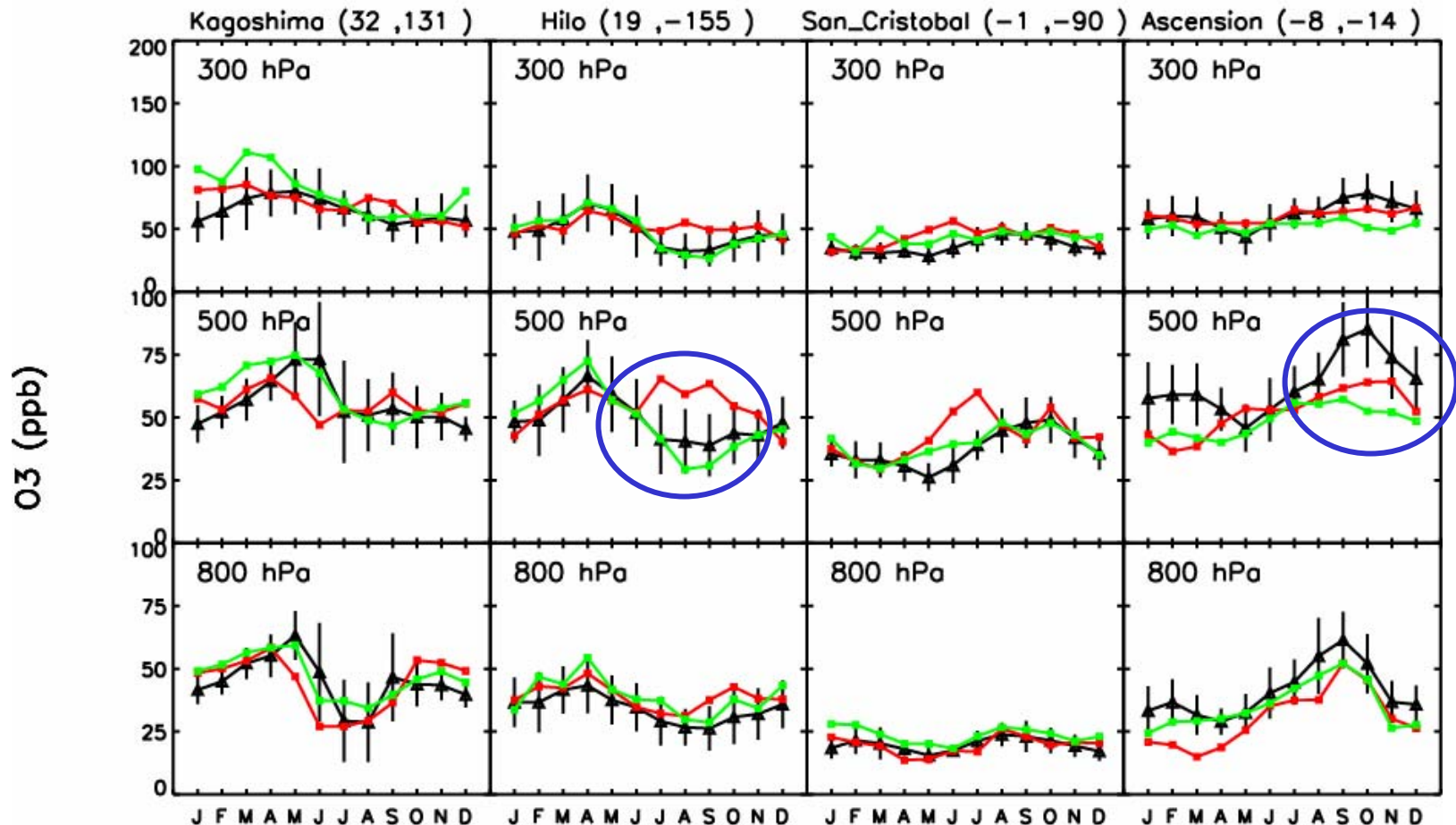
Combo - red, DAS - green.



FVGCM and **DAS**

Comparisons done for all
sonde stations, not shown
in this talk

Sub-tropics to tropics, FVGCM and DAS

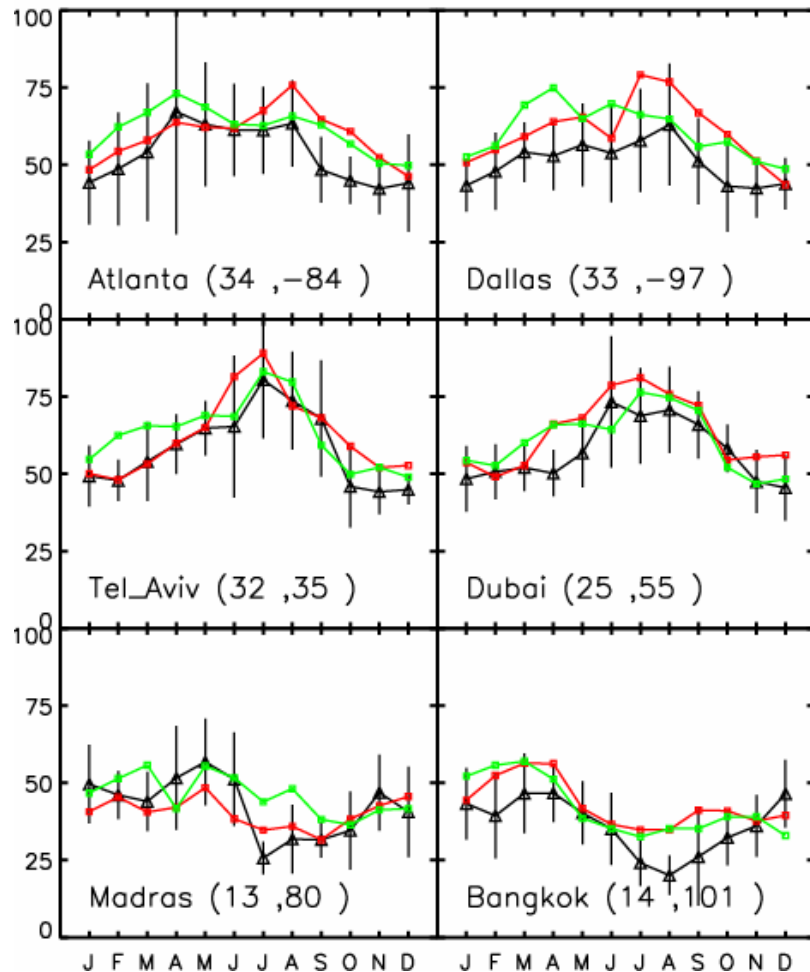


FVGCM has a problem at Hilo in 2x2.5, but not in 4x5.

DAS very low in BB season (NH and SH) in S. Atlantic

Southern US, Middle East. S. Asia, FVGCM and DAS

500 mbar. FVGCM winds. Combo – red, DAS – green.



Model looks pretty good.

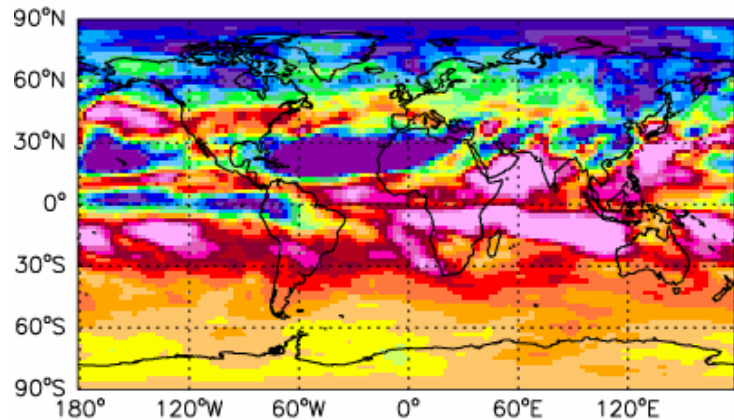
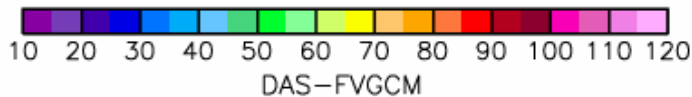
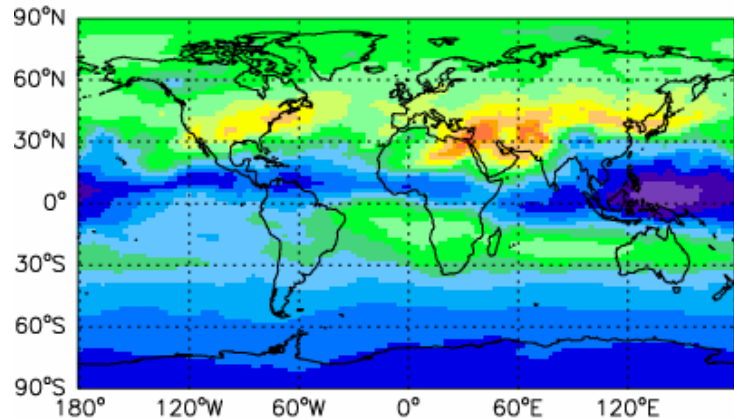
Improvement over 4x5 which was too high.

Ozone at 500 mbar.

Easterly jet may be too strong in FVGCM, too weak in DAS

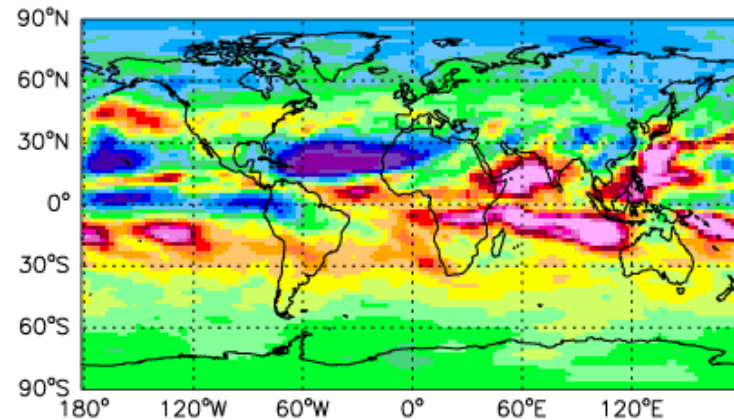
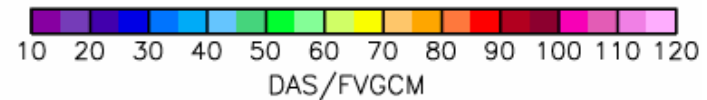
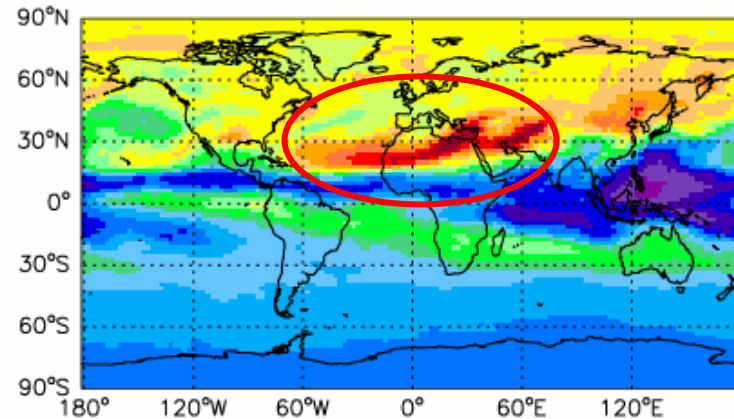
DAS

DAS

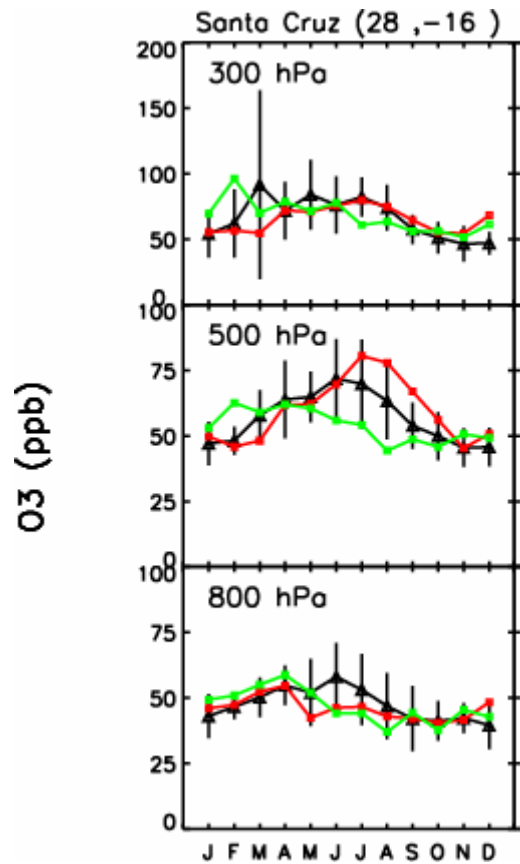


FVGCM

FVGCM



Santa Cruz in E. Atlantic, off African coast

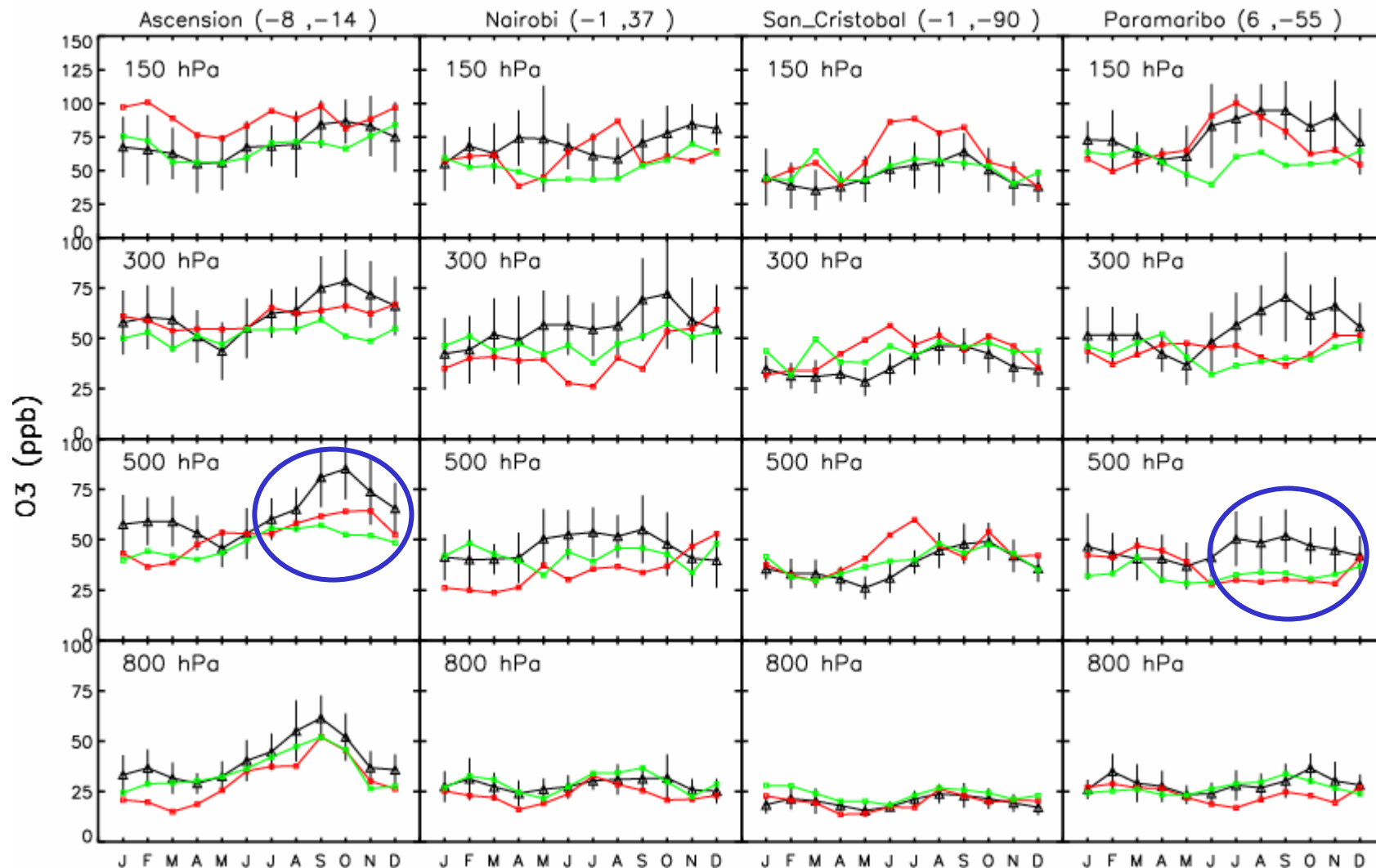


FVGCM
DAS

FVGCM
DAS

South tropics

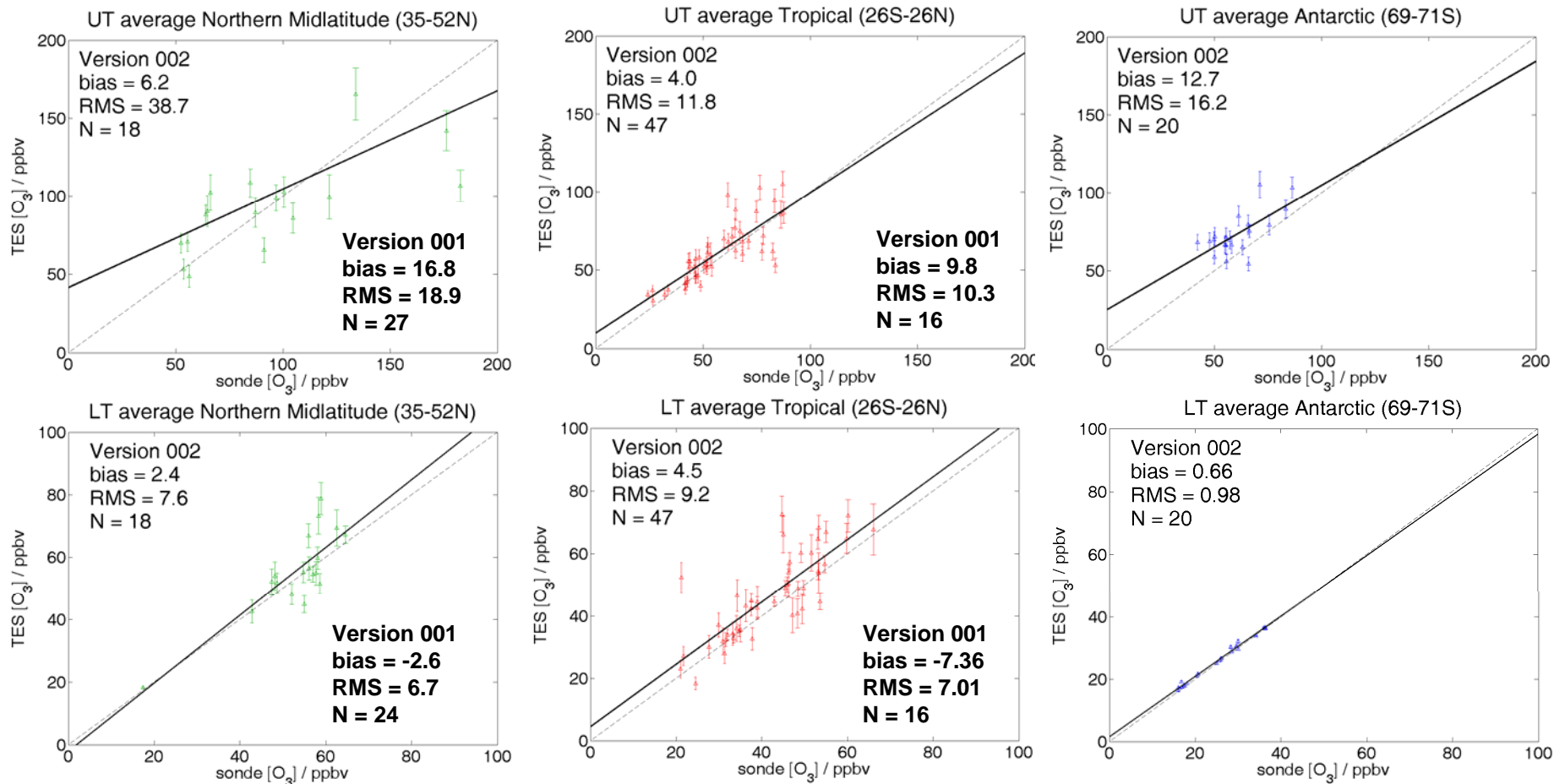
FVGCM winds. Combo – red, DAS – green.



TES – DAS comparisons

- Focus on July to December, 2005.
 - TES data much sparser before July 2005, before routine limb sounding was dropped.
 - First show summary of TES validation
-
- DAS output saved daily.
 - Model sampled at TES profile locations, and AKs and prior applied.
 - TES prior from MOZART model
 - Results gridded on 2x2.5 grid
 - Difference [(DAS with AK) – TES] removes prior

TES vs. ozonesondes in the UT (upper) and LT (lower) for 3 latitudes zones



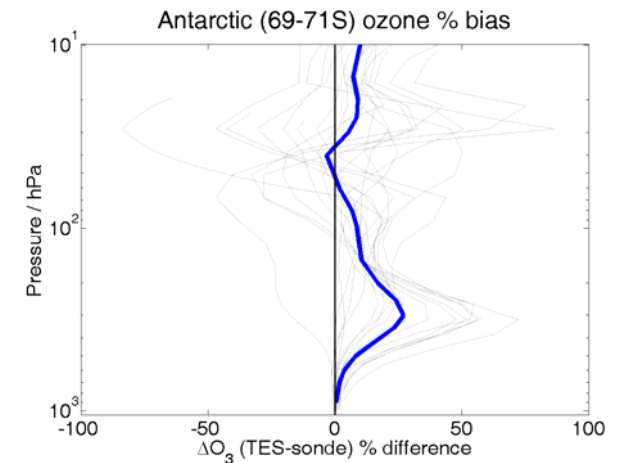
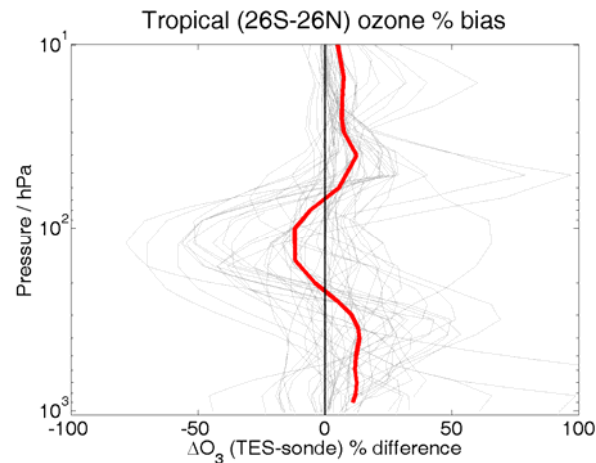
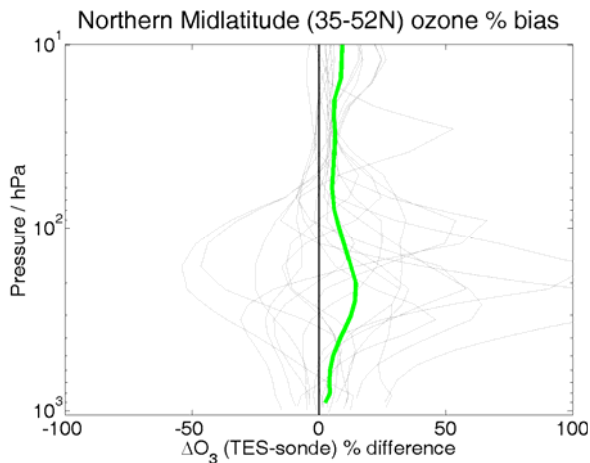
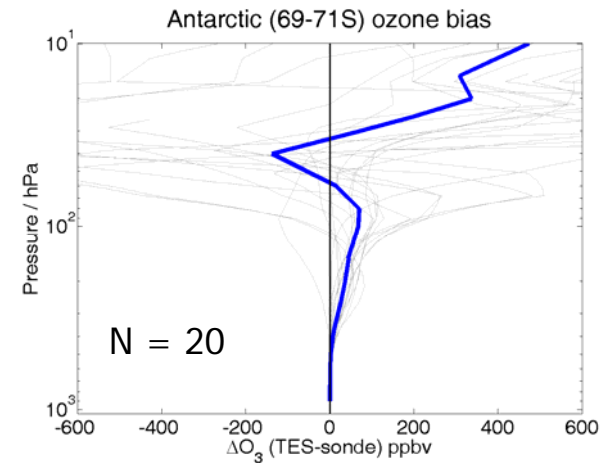
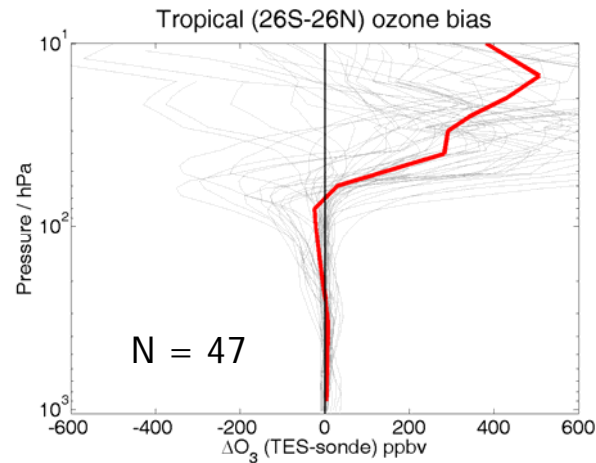
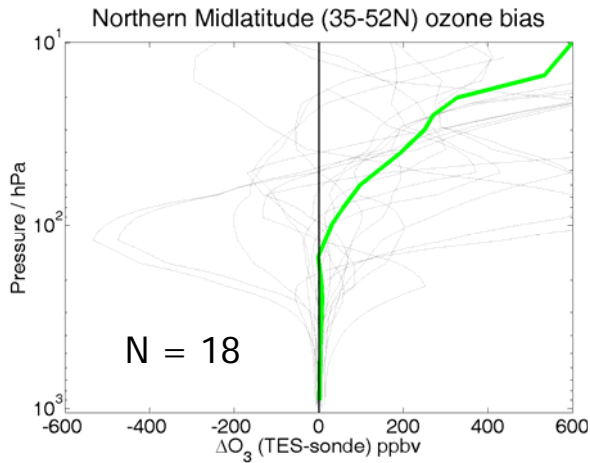
LT (surface - 500 hPa) and UT (500 hPa - 200 hPa or tropopause, whichever is larger)

Ray Nassar

Aura Science Team Meeting, NCAR, 2006 September 12

TES-sonde ozone differences in 3 latitudes zones

Mean bias in troposphere <15%, TES high.



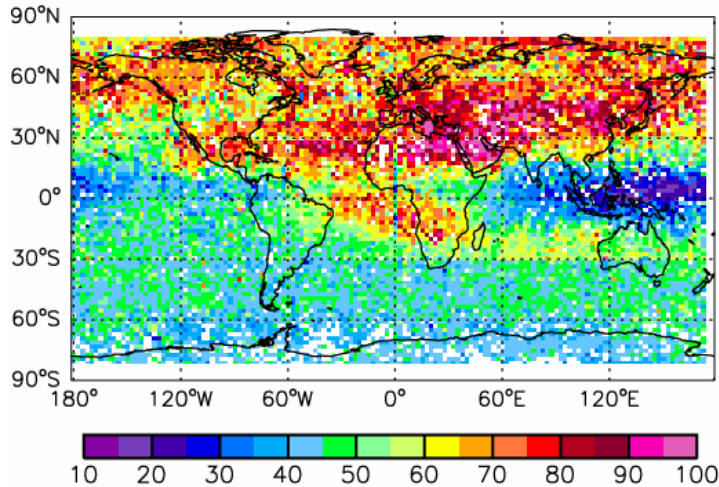
Ray Nassar

Aura Science Team Meeting, NCAR, 2006 September 12

Combo-DAS vs. TES ozone, July 2005

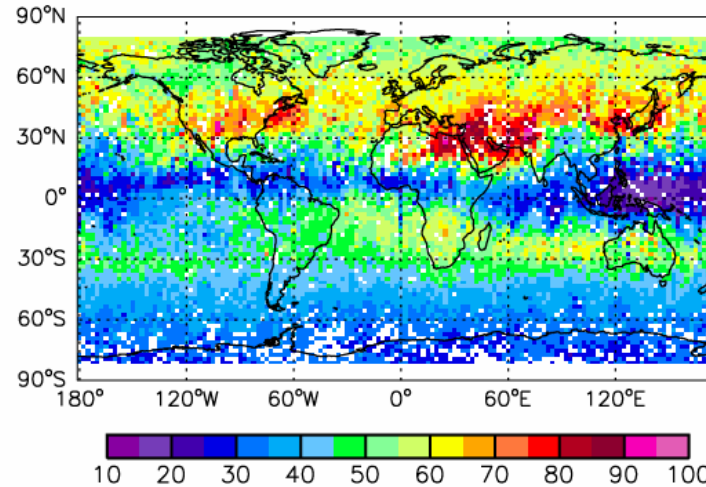
TES

03 TES, 511 mbar, 7/04/05–7/30/05



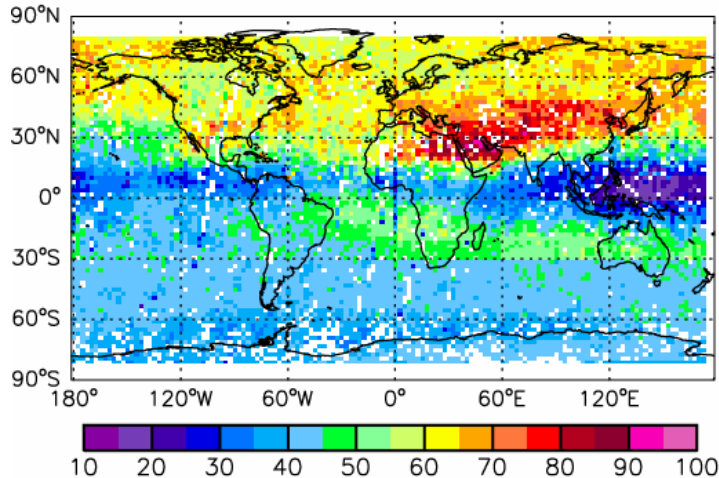
DAS

03 DAS w/o AK, 511 mbar, 7/04/05–7/30/05

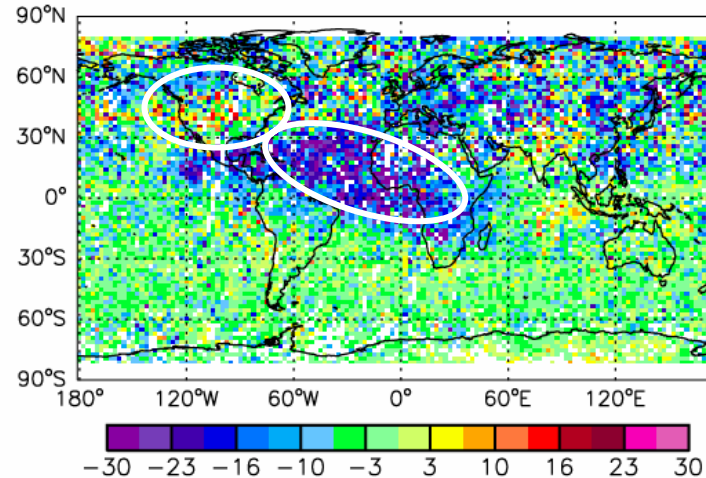


DAS with AK

03 DAS with AK, 511 mbar, 7/04/05–7/30/05



03 DAS–TES, 511 mbar, 7/04/05–7/30/05



**Difference,
removes prior**

Are TES comparisons consistent with validation of Combo-DAS using in-situ data?

TES comparison implies DAS is:

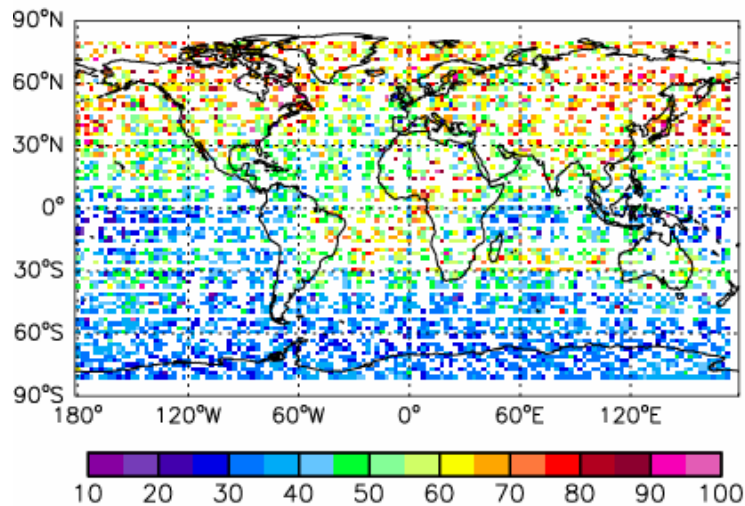
- Too high over U.S.
- Too low over W. Europe
- Too low in N. tropical Atlantic
- OK in Middle East
- OK in S. Atlantic
-

Dallas, but Boulder OK
European sondes
Santa Cruz, Adibjan
4 Mozaic locations
Ascension

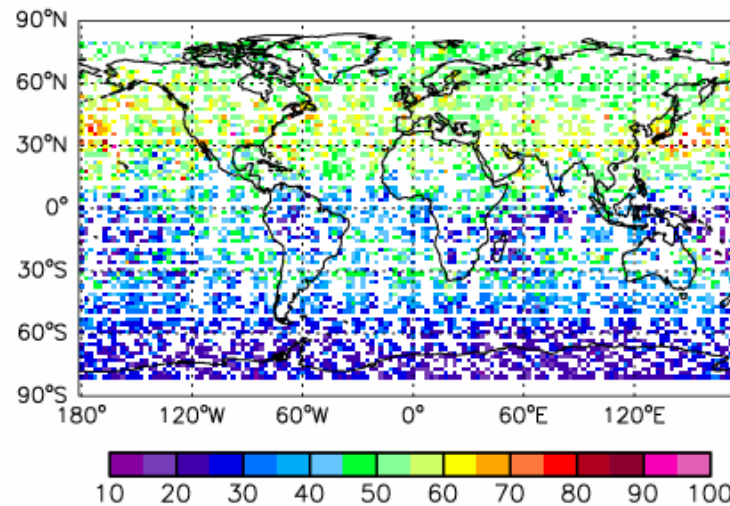
- First look suggests a fair degree consistency
- Needs a more rigorous assessment
- Indirect validation of TES possible

Combo-DAS vs. TES, ozone, January 2005

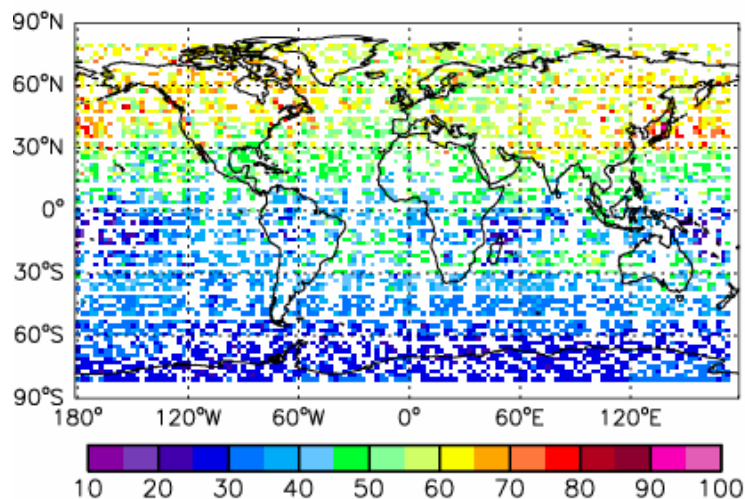
O3 TES, 511 mbar, 1/01/05–1/31/05



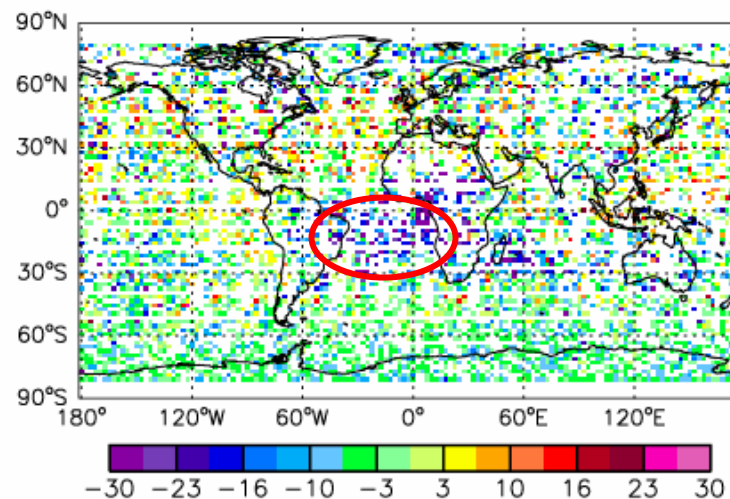
O3 DAS w/o AK, 511 mbar, 1/01/05–1/31/05



O3 DAS with AK, 511 mbar, 1/01/05–1/31/05



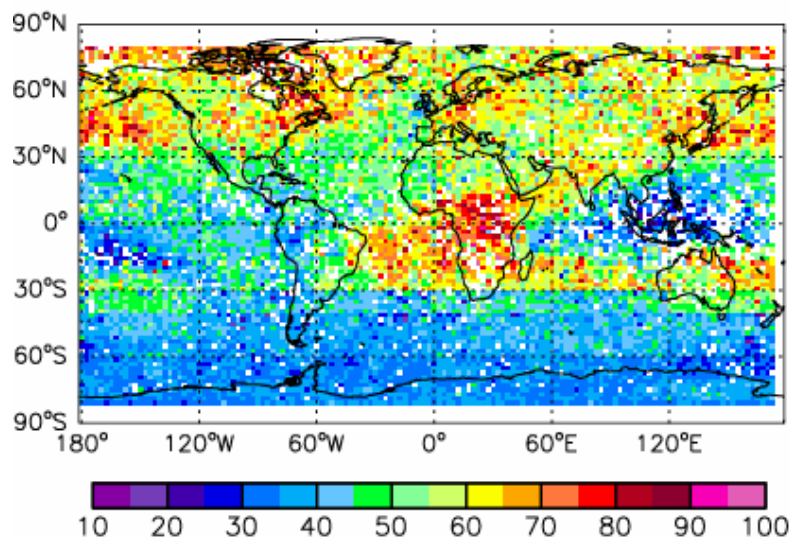
O3 DAS-TES, 511 mbar, 1/01/05–1/31/05



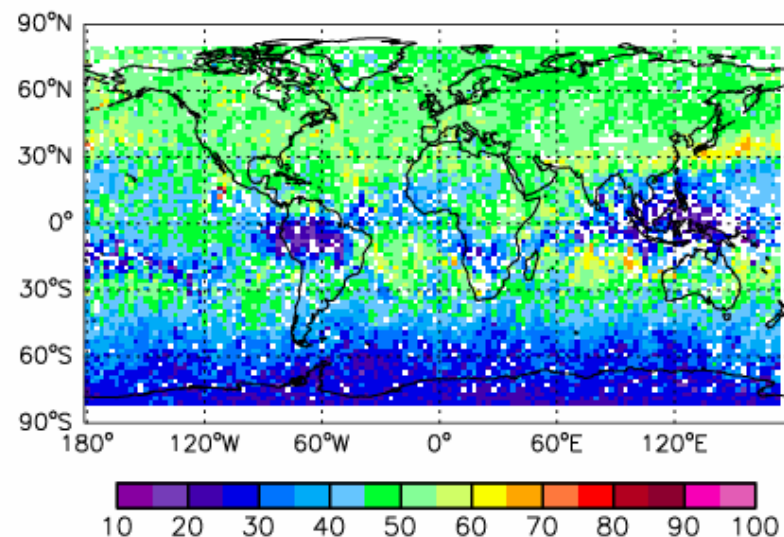
In January, far smaller region in Atlantic with large discrepancy

Combo-DAS vs. TES, December, 2005

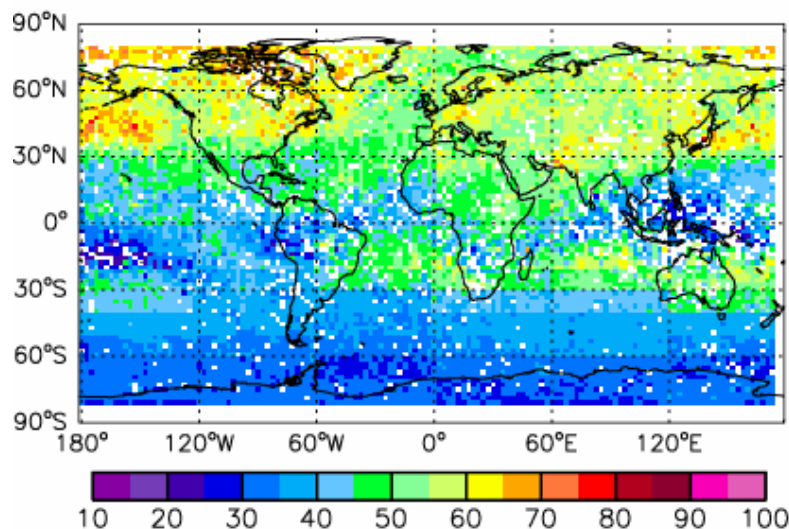
03 TES, 511 mbar, 12/07/05–12/29/05



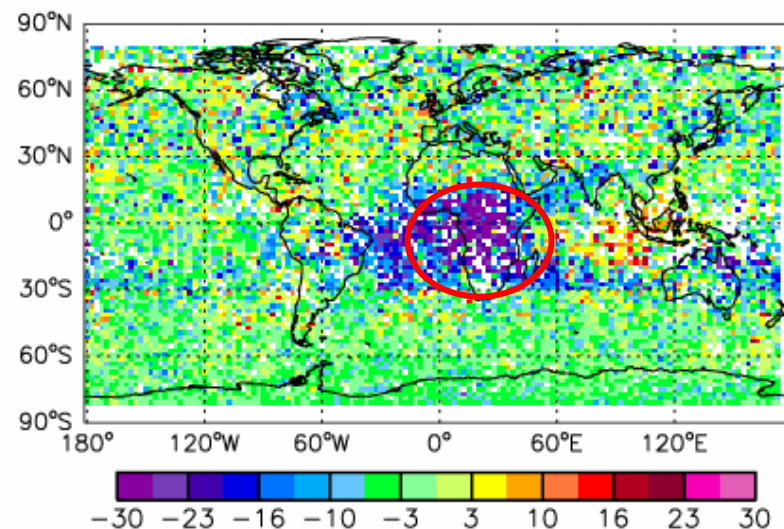
03 DAS w/o AK, 511 mbar, 12/07/05–12/29/05



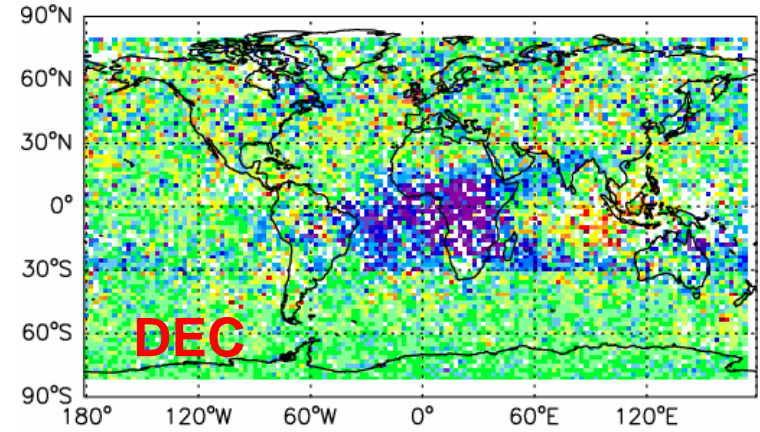
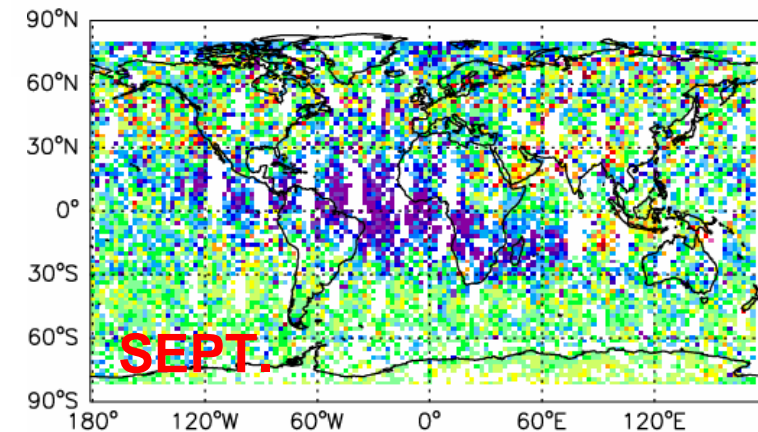
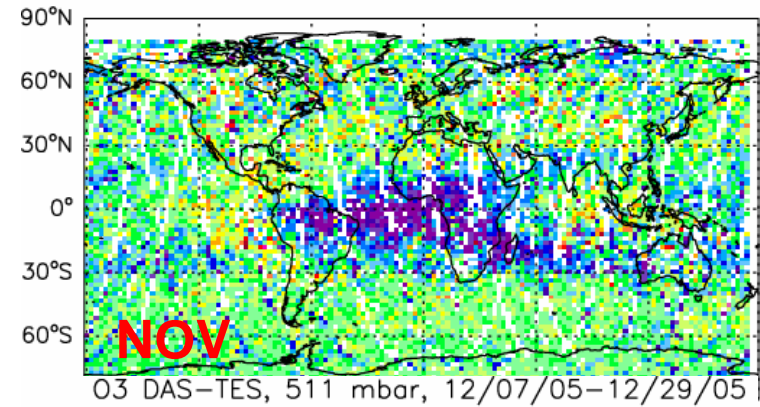
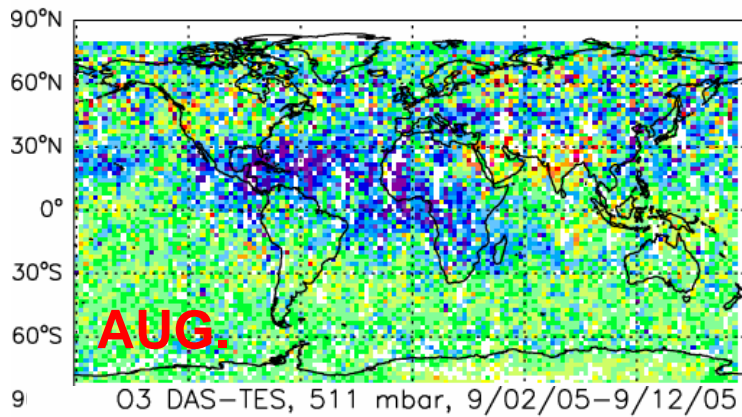
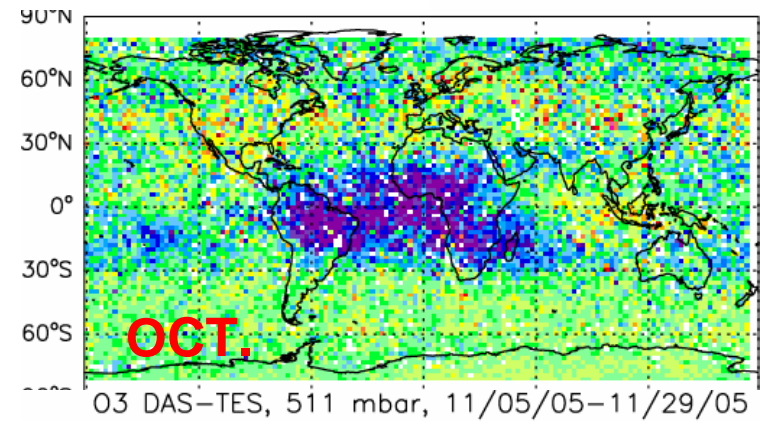
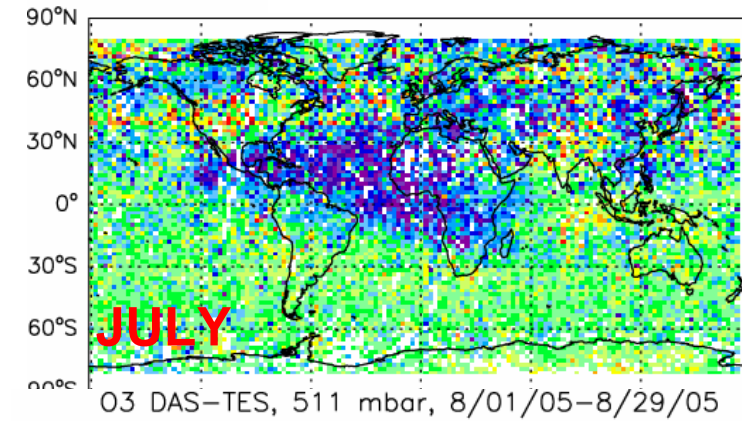
03 DAS with AK, 511 mbar, 12/07/05–12/29/05



03 DAS-TES, 511 mbar, 12/07/05–12/29/05



03 DAS-TE: **DAS - TES Differences, July - December** 10/02/05-10/30/05



Ozone Summary

- The COMBO-DAS looks remarkably like observed ozone in many regions, according to the sonde and MOZAIC data (~50 locations).
- Major discrepancies from sonde/MOZAIC data are in Atlantic sector, biomass burning season: Ascension, Natal, Paramaribo, Abidjan.
- TES comparisons show the spatial extent of the underestimate of ozone in
 - the N. tropical Atlantic in July, less so in August
 - N and S. tropical Atlantic in August
 - Brazil, equatorial Atlantic and Africa in October, November
 - Central Africa in December